PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements in and relating to Connecting Devices for Printed Circuit Boards

I, ROBERT FREDERICK OXLEY, a British subject, of Priory Park, Ulverston, Lancashire, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to connecting devices for printed circuit boards. Printed circuit boards are normally made of tough resinous material which may or may not be laminated with reinforcing webs. It is frequently necessary to secure a binding post, tag or equivalent device to a printed circuit board bearing a conductive pattern for the attachment of leads. It is also necessary to secure components such as resistors and capacitors to such boards. For these purposes various devices have been proposed for insertion into holes in the boards but these devices are usually inadequate for one reason or another.

According to the present invention a pin adapted to be secured in a hole extending through a printed circuit board has a gripper portion which is of generally circular cross-section having a number of projections on its surface evenly distributed around the circumference of the gripper portion and formed by at least six axially extending grooves intersected by at least two circumferentially extending grooves. When the pin is inserted into a hole in a printed circuit board the projections will bite into the internal surface of the hole in the board and will resist rotational forces and retractive forces on the pin.

It is to be understood that the pin may itself constitute a complete article and act as a binding post or tag to which a lead may be secured, for example by soldering, or may be part of a component such as a resistor or capacitor the pin then constituting a terminal of the component for electrical connection of the component to the conductive pattern of the board and for mechanical connection of the component to the board.

The circumferentially extending grooves may be so shaped that the projections are generally barb shaped; thus the projections may have upper surfaces which are in approximately axis-normal planes and lower surfaces which are tapered.

Preferably, the outer extremeties of the projections present a frusto-conical envelope. This feature is valuable as it enables a pin of a given size to be pressed into and retained in holes of various sizes, the depth of entry of the pin depending at least partially upon the particular diameter of the hole. Moreover, making the surface of the pin which engages the printed circuit board of tapered form reduces the tendency of parts of the printed circuit board to break away from around the hole on the exit side of the board when a pin is pressed through the hole.

Above the gripper portion the pin may carry a flange to prevent the pin being pressed too far into the hole.

The mere pressing of the pin into the hole in the board may be sufficient to make electrical contact between the pin and the conductive pattern on the board but in most cases it will be necessary to provide a solder connection. This may be facilitated by supplying the pin with a solder washer secured around the pin so that when the pin is inserted into a hole in the printed circuit board the solder washer will engage a conductive pattern on the board. The solder which is preferably prefluxed can be made to fuse by the application of heat to the pin whereupon an electrically conductive joint will be formed. The pin may be silver- or gold-plated to assist in the formation of good joints both with the conductive pattern and with external connections made to the pin.

The pin may extend beyond the gripper portion at the end to be first inserted into the

hole in the printed circuit board and this part of the pin may have various shapes provided that its external dimensions do not exceed those of the hole through which the pin is to be passed: This end of the pin may be used for the attachment of leads and may be grooved to facilitate this if required. It will be apparent that the opposite end of the pin may have any form or shape and is not restricted in diameter as it does not have to pass through the hole. As stated above the pin may be part of an electrical component which is to be attached to the printed circuit board and thus the component itself will be attached to this end of the pin. The invention may be carried into practice in various ways and one particular pin embodying the invention and two modifications will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a side elevation of the pin;

Figure 2 is a cross-section of the pin of Figure 1 taken on the line III—III;

Figure 3 is a cross-section through a small portion of printed circuit board carrying the pin shown in Figures 1 and 2 and also carrying two modified pins; and

Figure 4 is a plan view of the printed circuit board shown in Figure 3.

Referring now to Figures 1 and 2 of the drawings, there is shown a pin 1 which is divided approximately into two halves by a flange 2. The pin is made of brass and is silver or gold plated. The part of the pin 3 above the flange 2 is of constant circular cross-section and forms a terminal to which leads can be attached by for example, soldering or wrapping. Below the flange 2 there is a short length 4 of the same diameter as the upper part 3. Below the portion 4 is a gripper portion 5 having a particular surface configuration which will be described in greater detail below, and below the gripper portion there is a lower portion 6 which has a diameter which is slightly smaller than that of the upper portion 3 and terminates in a rounded end 7.

The gripper portion 5 is divided by four circumferential grooves 8 which are formed with an axis-normal surface 8*a* and a surface 8*b* which is inclined to the longitudinal axis of the pin 1 by an angle of approximately 15°. The pin is thus formed with four tapered or barb-like circumferential enlargements. This portion of the pin is also formed with twelve longitudinally extending V-shaped grooves 9 (see Figure 2) which intersect the circumferential grooves 8. The gripping surface 5 is thus formed with a large number of small projections each of which is approximately pyramid shaped and has an upper surface which is normal to the axis of the pin and faces towards the upper end of the pin and two side surfaces formed by the grooves 9.

The outer surface of the gripper portion 5 is frusto-conical before the grooves 8 and 9 are formed so, after formation of the grooves, the outer extremities of the projections form an envelope which is frusto-conical, the half cone angle α being comparatively small.

On the left hand side of Figure 3 there is shown the pin of Figures 1 and 2 in position in a printed circuit board 11. The end 7 of the pin is entered into a preformed hole 12 in the board and the pin is then pressed into the hole until it is firm. In the case being described the diameter of the hole 12 is such that the pin can be pressed in until the flange 2 engages the upper surface of the board. However, if the diameter of the hole 12 was slightly smaller the tapered shape of the gripper portion 5 would cause the pin to be gripped in the hole before the flange 12 reached the board 11. When the pin is in position in the hole the projections of the gripper portion 5 of the pin bite into the surface of the hole and the pin is thus firmly retained in the hole, the side surfaces of the projections acting as splines to prevent rotation of the pin and the upper surfaces of the projections acting as barbs to prevent retraction of the pin. Leads can then be connected to each end of the pin to form an electrical connection between the opposite sides of the printed circuit board 11.

The pin 13 shown in the centre of Figures 3 and 4 is similar to that shown in Figures 1 and 2 except that the upper end of the pin is formed as a socket 14 which has a split wall 15 to provide resiliency. The socket is surrounded by a circlip 16. The socket 14 can receive any suitable form of probe or plug and the circlip 16 may be repaced by a bushing of a resilient material such as polytetrafluoroethylene (P.T.F.E.). The pin may have sockets in each end if required. The plugs may be used to form circuit connections or may be used for monitoring of circuits in which the pin is incorporated.

The pin shown to the right of Figures 3 and 4 is the same as that shown in Figures 1 and 2 except that the portion 17 between the flange 2 and the gripper portion is somewhat longer than the corresponding portion 4 of the first pin. This portion 17 is surrounded by a washer 18 of prefluxed solder. The pin is supplied with the prefluxed ring of solder in position on the pin and when the pin is inserted into the printed circuit board through a hole passing through a conductive printed circuit pattern 19 on the board, the solder ring will be positioned between the printed circuit pattern 19 and the flange 2. The application of heat to the end of the pin will cause the solder 18 to melt and a highly effective electrical connection will be made between the pin and the conductive pattern.

Although in most cases the pin will be pressed through preformed holes in the printed circuit boards, it may in some cases be possible for the pins to be pressed through the board

without the existence of apertures and for the pins to make their own holes.

WHAT I CLAIM IS:—

1. A pin adapted to be secured in a hole extending through a printed circuit board and having a gripper portion which is of generally circular cross-section having a number of projections on its surface evenly distributed around the circumference of the gripper portion and formed by at least six axially extending grooves intersected by at least two circumferentially extending grooves.

2. A pin as claimed in Claim 1 in which the gripper portion lies between two end portions free from grooves.

3. A pin as claimed in Claim 1 or Claim 2 in which the circumferentially extending grooves are so shaped that the projections are generally barb-shaped.

4. A pin as claimed in Claim 3 in which the projections have upper surfaces which are in approximately axis-normal planes and lower surfaces which are tapered.

5. A pin as claimed in any of the preceding claims in which the outer extremeties of the projections form a frusto-conical envelope.

6. A pin as claimed in any of the preceding claims in which there is an outwardly extending flange intermediate to the length of the pin and adjacent one end of the gripper portion.

7. A pin as claimed in any of the preceding claims in which at least one end of the pin is formed with an axially extending socket.

8. A pin as claimed in Claim 7 in which the wall of the socket is longitudinally slit in at least one place and there is means surrounding the socket to give resilient support to the socket.

9. A pin as claimed in any of the preceding claims including a solder washer surrounding the pin and adapted to engage a conductive pattern on a printed circuit board into which the pin is fixed.

10. A pin substantially as described herein with reference to Figures 1 and 2 of the accompanying drawings.

11. A pin as claimed in Claim 12 modified in either of the ways described herein with reference to Figures 3 and 4 of the accompanying drawings.

12. A printed circuit board having at least one pin as claimed in any of the preceding claims secured in a hole therethrough.

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Agents for the Applicant.

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1 SHEET

COMPLETE SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale.

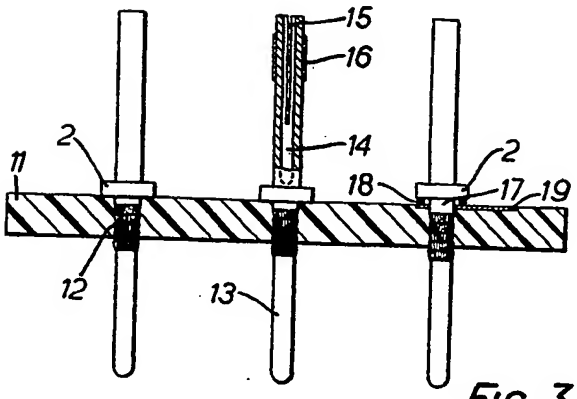

FIG. 3.

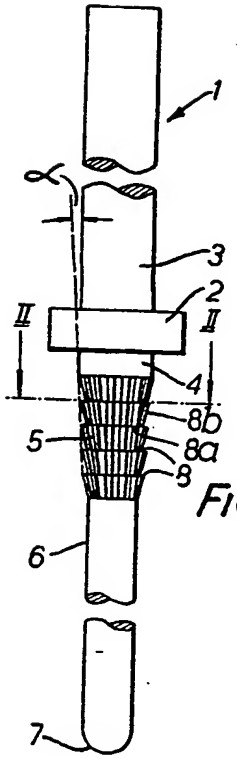

FIG. 1.

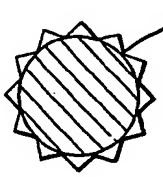

FIG. 2.

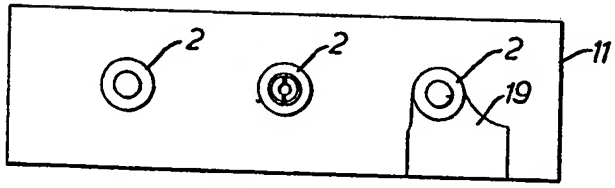

FIG. 4.